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FIGURANCE (U. 133)
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# United States Patent [19]

# Sinofsky

### Patent Number: [11]

5,843,073

# **Date of Patent:**

WO83/01893

\*Dec. 1, 1998

# [54] INFRARED LASER CATHETER SYSTEM

Inventor: Edward Lawrence Sinofsky, Reading,

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Yarmouth, Mass.

[\*] Notice: The term of this patent shall not extend

beyond the expiration date of Pat. No.

4,917,084.

[21] Appl. No.: 411,581

[22] Filed: Mar. 29, 1995

# Related U.S. Application Data

Continuation of Ser. No. 568,348, Aug. 15, 1990, which is a division of Ser. No. 568,348, Aug. 15, 1990, which is a continuation of Ser. No. 257,760, Oct. 14, 1988, Pat. No. 4,950,266, which is a continuation of Ser. No. 14,990, Feb. 17, 1987, abandoned, which is a continuation of Ser. No. 761,188, Jul. 13, 1985, abandoned.

[51]	Int. Cl.6	***************************************		A61	N 5/06
[52]	U.S. Cl.	••••••••••	606/10;	-	606/7;

606/15 Field of Search ...... 606/2, 3–19; 600/104, 600/108

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214712	3/1989	European Pat. Off.
1073914	6/1985	U.S.Ŝ.R
2017506	10/1979	United Kingdom .
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"Reduction of Laser Inducted Pathological Tissue Injury Using Post-Energy Delivery", by L. Deckelbaum et al., vol. 56, Oct. 1, 1985, pp. 662-667. \*

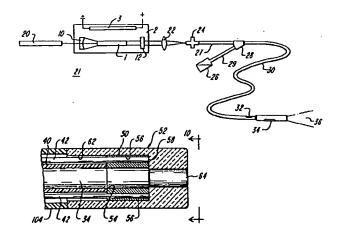
(List continued on next page.)

Primary Examiner-David M. Shay Attorney, Agent, or Firm-Thomas J. Engellenner; Lahive & Cockfield, LLP

### **ABSTRACT**

Laser energy produced by a laser operating in the midinfrared region (approximately 2 micrometers) is delivered by an optical fiber in a catheter to a surgical site for biological tissue removal and repair. Disclosed laser sources which have an output wavelength in this region include: Holmium-doped Yttrium Aluminum Garnet (Ho:YAG), Holmium-doped Yttrium Lithium Fluoride (Ho:YLF), Erbium-doped YAG, Erbium-doped YLF and Thuliumdoped YAG. For tissue removal, the lasers are operated with relatively long pulses at energy levels of approximately 1 joule per pulse. For tissue repair, the lasers are operated in a continuous wave mode at low power. Laser output energy is applied to a silica-based optical fiber which has been specially purified to reduce the hydroxyl-ion concentration to a low level. The catheter may be comprised of a single optical fiber or a plurality of optical fibers arranged to give overlapping output patterns for large area coverage.

# 13 Claims, 6 Drawing Sheets







# United States Patent [19]

# **Sinofsky**

# [11] Patent Number:

5,843,073

[45] Date of Patent:

6/1983

WO83/01893

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### [54] INFRARED LASER CATHETER SYSTEM

[75] Inventor: Edward Lawrence Sinofsky, Reading,

Mass.

[73] Assignee: Rare Earth Medical, Inc., West

Yarmouth, Mass.

[\*] Notice: The term of this patent shall not extend beyond the expiration date of Pat. No. 4,917,084.

[21] Appl. No.: 411,581

[22] Filed: Mar. 29, 1995

# Related U.S. Application Data

[60] Continuation of Ser. No. 49,147, Apr. 19, 1993, which is a division of Ser. No. 568,348, Aug. 15, 1990, which is a continuation of Ser. No. 257,760, Oct. 14, 1988, Pat. No. 4,950,266, which is a continuation of Ser. No. 14,990, Feb. 17, 1987, abandoned, which is a continuation of Ser. No. 761,188, Jul. 13, 1985, abandoned.

[51]	Int. Cl.6			A61N 5/06
[52]	U.S. Cl.		606/10; 6	06/3; 606/7;
		:		606/15

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Primary Examiner—David M. Shay Attorney, Agent, or Firm—Thomas J. Engellenner; Lahive & Cockfield, LLP

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